Principles of Environmental Restoration

Applying the Principles to Response Design and Implementation

Objectives

- Apply the four principles of environmental restoration to response design and implementation
- Provide framework and tools for conducting response design and implementation in light of inherent uncertainties

Principles Translated through the Remediation Process

Principle	Pre-Decision Document	Post-Decision Document		
		Design	Implementation	Post-Completion or Construction
Define objective and maintain focus on It (What needs to be done?)	Clear, concise statement of problem	Clear, concise statement of restoration objective	Clear, concise definition of closure - performance measurement based on that definition	Clear, concise definition of completion - performance measurement based on that definition
Early identification of probable means of achieving objective (How will it be done?)	Early identification of likely response actions	Early identification of likely design basis	Early development of draft work plans	Early identification of post-construction procedures for long term care
Uncertainties are inherent and must be managed (What are expected conditions and potential deviations?)	Evaluate effects uncertainty could have on response selection	Evaluate effects uncertainty could have on response design	Monitor indicators to provide early warning on which contingency will likely be needed, if any	Monitor indicators to provide early warning that response will fail to meet objective
Early open communication and consensual decision making by project team	Prepare problem statement, select response action and accept level of residual uncertainties	Develop consensus interpretation of decision document, approve designs, approve residual uncertainty management plan, and define/agree on objectives	Interpret performance measurement and contingency monitoring results, and approve implementation of contingencies	Review monitoring data, implementation of contingencies and be involved in 5 year reviews

Define Objective and Maintain Focus on It

- Translate the requirements of the decision document into description of:
  - Overall objectives
  - Performance criteria
  - Determination of when project reaches completion

Defining Objective during RDI

- Primary objective is achieved by working with the decision document to identify/clarify:
  - Performance objectives
  - Response action and its components
  - Criteria and standards
  - Other requirements and conditions
- Once "what" is required is identified, need to select performance metrics and criteria to define:
  - What we're measuring and how
  - Point for establishing objectives

Early Identification of Probable Means of Achieving Objective

- Identify areas of flexibility in decision documents that can be leveraged to optimize design and implementation
- Identify opportunities for continual improvement
- Identify opportunities to optimize projects and incentivize contractors

Means of Achieving Objective during RDI

- Select design basis for developing plans and specifications
- Capture optimization/innovation opportunities
- Manage uncertainty with project delivery strategies
- Look for ways to incentivize projects

Uncertainties are inherent and must be managed

- Once a response is selected, must evaluate implementation uncertainties including:
  - The range of values surrounding the selected design basis
  - The potential effects should project encounter conditions different than the estimate upon which the design is based

Managing Uncertainties during RDI

- Mitigate uncertainties arising from incomplete knowledge or changes in site conditions, technology performance, and regulatory requirements
- Evaluate impacts if estimates in design basis are different than what is encountered
- Ensure response is meeting all objectives
- Decide appropriate level of contingency development

Example Uncertainty Evaluation

Component	Design Basis	Range	Threshold	Impact	Probability	Monitoring	Contingency	Time to Implement
Excavation	No utilities	Water Storm sewer Electrical	Any one utility	Halt excavation Damage or disrupt service	Low	Visual	Cocoon Hand dig	1-2 day 1-2 day
	Only Cr (III) present	Cr (VI) present	> RCRA limits	Remedy illegal w/o treatment Delay while new plan approved Revised H&S plan Staging areas Delays in analytical services	Moderate	Field wet chemistry Visual	Contract to ship/treat off-site TSD Reduce to Cr (III)	30-60 days if contingency not developed, including all permits and contracts, prior to implementing response

Early Open Communication and Consensual Decision Making by Core Team

- Role of the core team evolves from the pre-decision stages through design and implementation

Consensus Decision Making during RDI

Investigation/ Assessment Phase

Core Team — *Directs* → **Project Team**

Consensus on major decisions such as:

- ✓ Site conceptual model
- ✓ Project objectives
- ✓ Selects response
- ✓ Identifies uncertainties to be reduced and those for which contingencies will be developed to counteract impacts

Supports decisions by supplying inputs such as:

- ✓ Work Plans
- ✓ Results of investigation
- ✓ Risk analysis

Action Phase (RDI)

Core Team — *Directs* → **Project Team**

Consensus on major decisions such as:

- ✓ Interpretation of decision document
- ✓ Contingency plans
- ✓ Performance measures
- ✓ Threshold values
- ✓ Appropriate time to implement contingencies
- ✓ Long-term options

Supports decisions by supplying inputs such as:

- ✓ Alternate contingencies
- ✓ Alternate performance measurement schemes
- ✓ Conducts RDI
- ✓ Collects performance measurement data
- ✓ Develops long-term care alternatives, O&M, and other monitoring plans

Interrelationship among principles during RDI